PROJECT facts

U.S. Department of Energy
National Energy Technology Laboratory
Office of Energy Efficiency and Renewable Energy
Office of Industrial Technologies

Advanced Turbine and Engine Systems

05/2000

Developing Power for the 21st Century – The Rolls-Royce Allison Engine Company Project

PRIMARY PARTNER

Rolls-Royce Allison Engine Company
Indianapolis, IN

MAIN SITE

Indianapolis, IN

TOTAL ESTIMATED COST

$82,500,000

COST SHARING

DOE	$48,675,000
Non-DOE	$33,825,000

Description

The common goal of the U.S. Department of Energy and the industrial gas turbine industry through the Advanced Turbine System Program continues to be development of electrical power generation systems and prime movers that are environmentally friendly and highly efficient and that provide positive economic impact. This can only be done by extending the technological state-of-the-art in gas turbine engine design.

The objective at Rolls-Royce Allison is to advance state-of-the-art technologies that provide building blocks contributing to the design, development, and demonstration of gas turbine engines with thermal efficiency improvements of 15 percent over the present levels in a given power class. In parallel, combustion technology is being developed to reduce the emission levels to less than 9 parts per million (ppm) for nitrogen oxides (NO_x) and 20 ppm for carbon monoxide (CO). To successfully commercialize these technologies, the safety, durability, reliability, and maintainability of the resulting products must be maintained or improved. The gas turbine is integrated into a generator set package, which must also have improvements that will reduce the overall system operating expense to lower the cost of electrical power at the busbar by at least 10 percent. Efforts in all of these areas make positive contributions to the environmental impact of powerplant operation.

The combustion development initiatives at Rolls-Royce Allison are focused on two areas of low emission technology: staged, lean premix (LPM) fuel injection and catalytic combustion. Lean premix modules are being developed that inject the fuel into the combustion air and provide a uniform, homogeneous mixture which is aerodynamically stable over a wide range of engine operating conditions. Operation of these modules can be staged to provide operational flexibility throughout a range from low power to full capacity while maintaining low emissions. As the development progresses, liquid fuel operation will be added. The goal is to develop a module that may be scaled to use over a broad range of pressure ratios and operating temperatures that can be applied over a broad spectrum of engine sizes. Under catalytic combustion, Rolls-Royce Allison is working on engine operability over the power range and catalyst durability in the operating environment of the various applications. Commercial demonstrations are planned for both LPM and catalytic combustion systems.

Engine efficiency improvements are centered on high-temperature turbine components, including turbine disk materials, ceramic vane design and manufacturing, and turbine airfoil cooling advances. Each of these areas can contribute to environmental improvements because efficiency improvements mean less fuel burned for the power provided.

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Duration

Start Date	October 1995
Projected End Date	December 2001

Goal

The goal of Rolls-Royce Allison is to design, develop, and demonstrate component technologies that can be successfully integrated into their existing product lines (namely the 601-K engine family). This application of advanced combustion technologies within an exitsting engine system permits earlier introduction of low emission technology into production engines. This goal will be achieved while demonstrating (1) emissions performance levels of less than 9 ppm for oxides of nitrogen and 20 ppm for carbon monoxide; and (2) improvements in reliability, safety, and durability.

Benefits

The project will inject these innovative and cost effective technologies into existing and new engine platforms to maximize the benefits of the DOE's and industry's investment. The Allison project will provide a high-performance, cost-effective package designed as a state-of-the-art industrial ATS that will address power-plant needs well into the 21st century.

Key Milestones

September 1997	Full Scale Staged Combustion testing commences
October 1997	Engine Design Layout complete
December 1997	Combustion rig testing of 8-in. dia at Industry of the Future site
January 1999	Engine development testing of ceramic vanes on 501-K gas turbine
July 1999	501-K Ceramic Vane Field test commences at Industry of the Future site
November 1999	9 ppm NO_x gas rig test
November 2000	ATS combustion concept low NO_x emission engine demonstration

CONTACT POINTS

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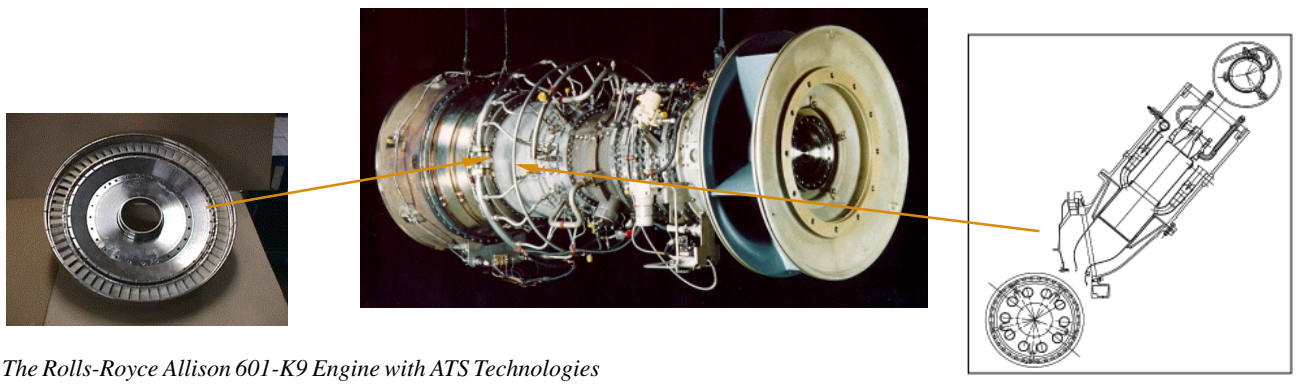

The Rolls-Royce Allison 601-K9 Engine with ATS Technologies